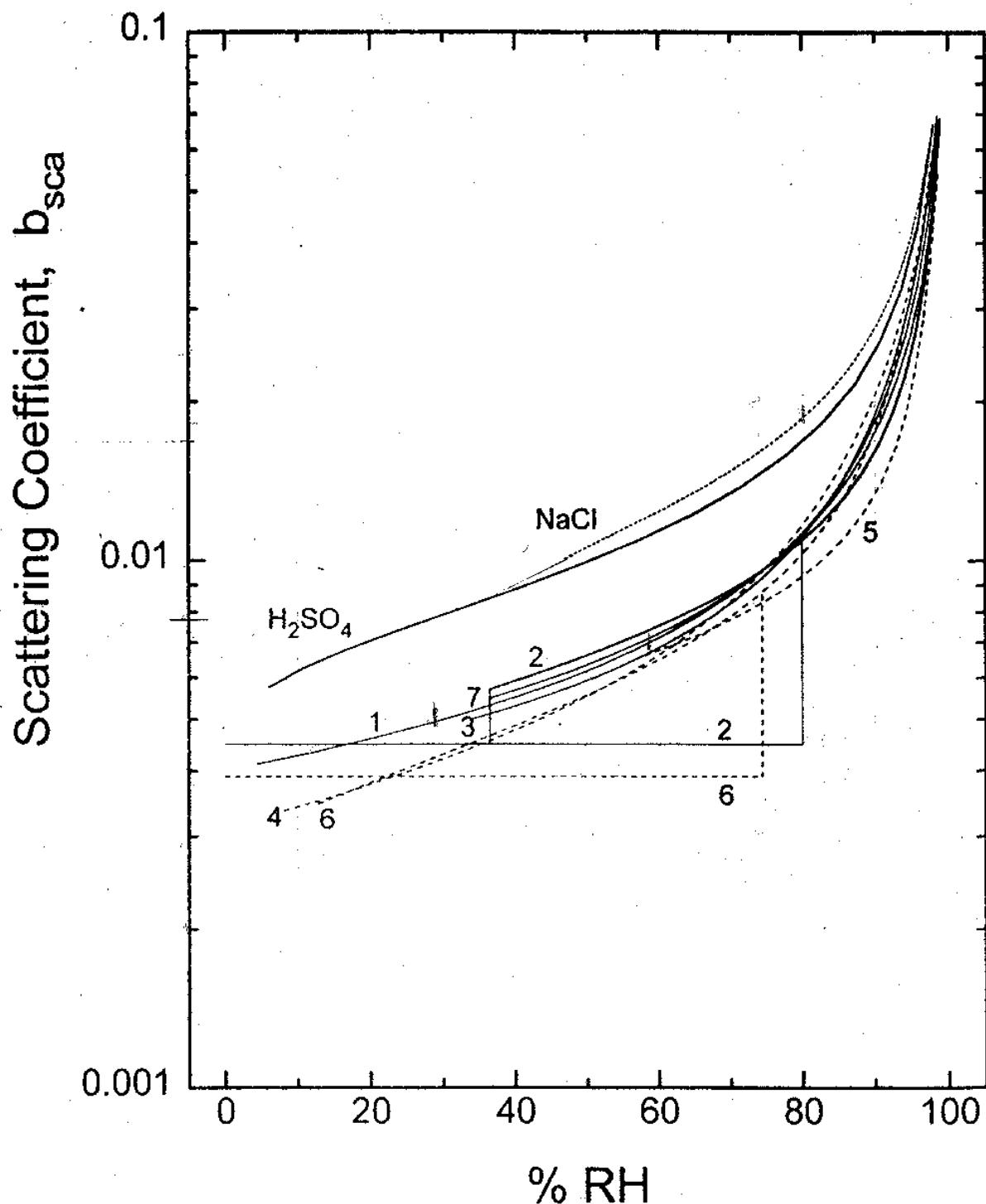


# **The impact of organics on Aerosol light-scattering in the**

## **MBL**

### **Some proposed airborne measurements during RED**

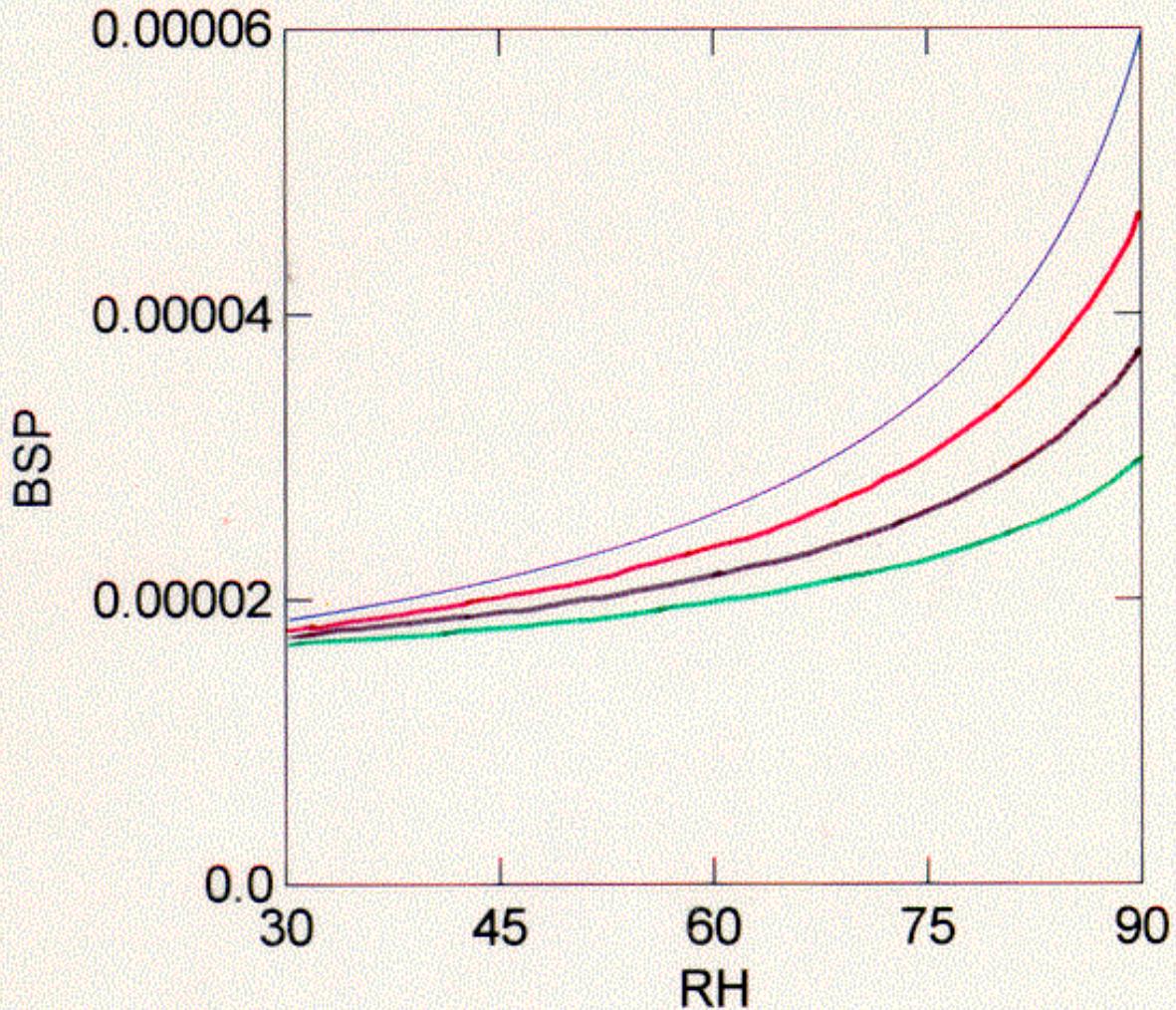


**Figure 5.** Light scattering by hygroscopic aerosols ( $D_g = 0.3 \mu\text{m}$ ,  $\sigma_g = 1.5$ ). 1,  $\text{NH}_4\text{HSO}_4$ ; 2,  $(\text{NH}_4)_2\text{SO}_4$ ; 3,  $\text{NH}_4\text{NO}_3$ ; 4,  $\text{NaHSO}_4$ ; 5,  $\text{Na}_2\text{SO}_4$ ; 6,  $\text{NaNO}_3$ ; 7,  $(\text{NH}_4)_3\text{H}(\text{SO}_4)_2$ .

# Parameterization of the effect of RH on aerosol light-scattering

- The most widely used parameterization is based on the work of Hänel (1976) and is given by:

$$\sigma_{sp}(RH) = \sigma_{sp}(RH_0) \left[ \frac{1 - RH/100}{1 - RH_0/100} \right]^{-\gamma}$$



$\underline{\gamma}$

- 0.6 —
- 0.5 —
- 0.4 —
- 0.3 —

**Table 3.** Values of  $\gamma$  Based on the Model of  
*Ming and Russell [2001]*

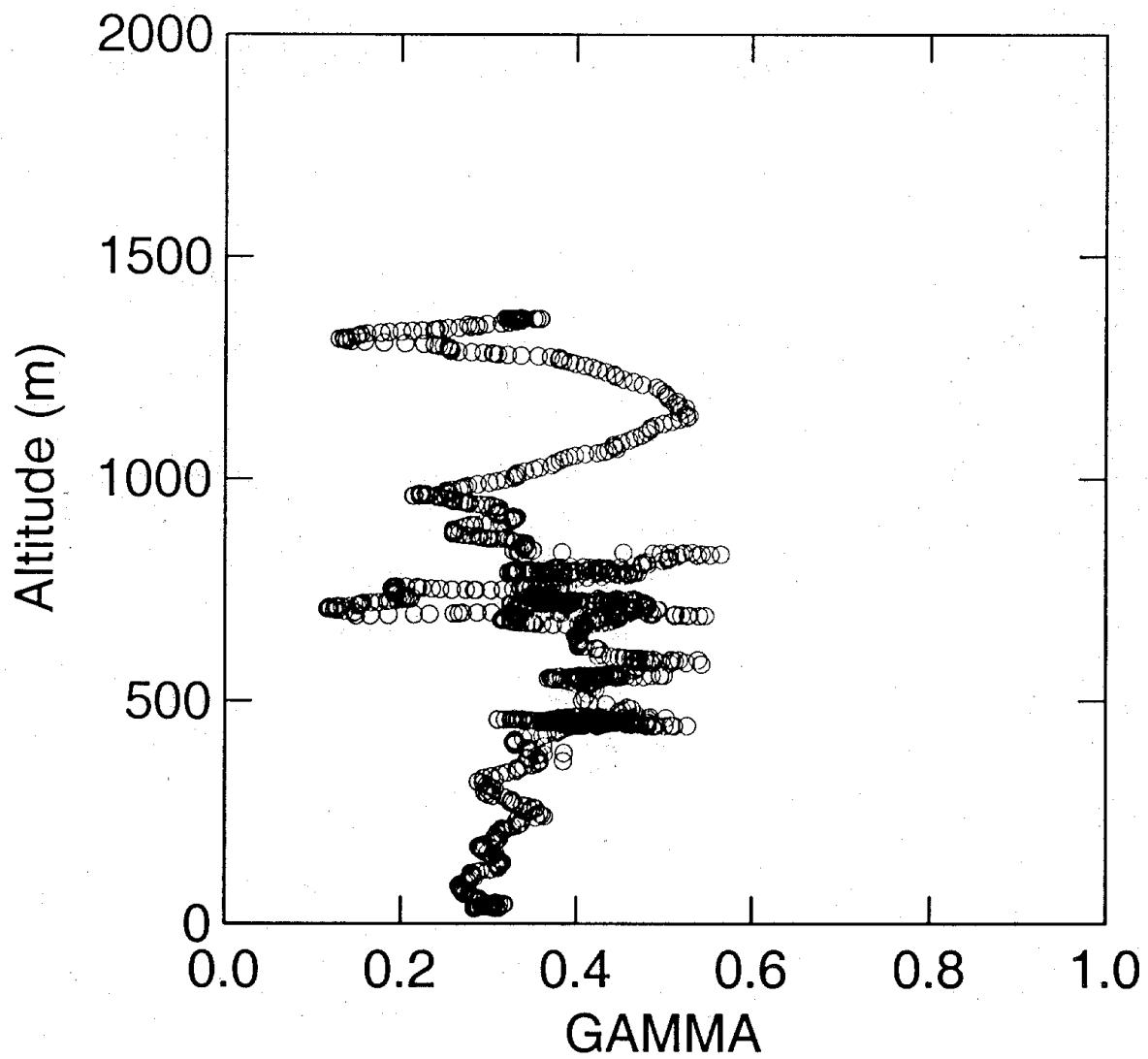
Aerosol Type	$\gamma^1$ (fine)	$\gamma^2$ (coarse)
NaCl	0.90	0.63
Inorganic sea salt	0.83	0.58
Sea salt (10% organic)	0.77	0.52
Sea salt (30% organic)	0.67	0.47
Sea salt (50% organic)	0.57	0.40
Sea salt (100% organic) <sup>3</sup>	0.13	0.09

<sup>1</sup>Calculated for conditions where submicron aerosol dominate scattering,  $D_{gn} = 0.1 \mu\text{m}$ ,  $\sigma_g = 1.8$ .

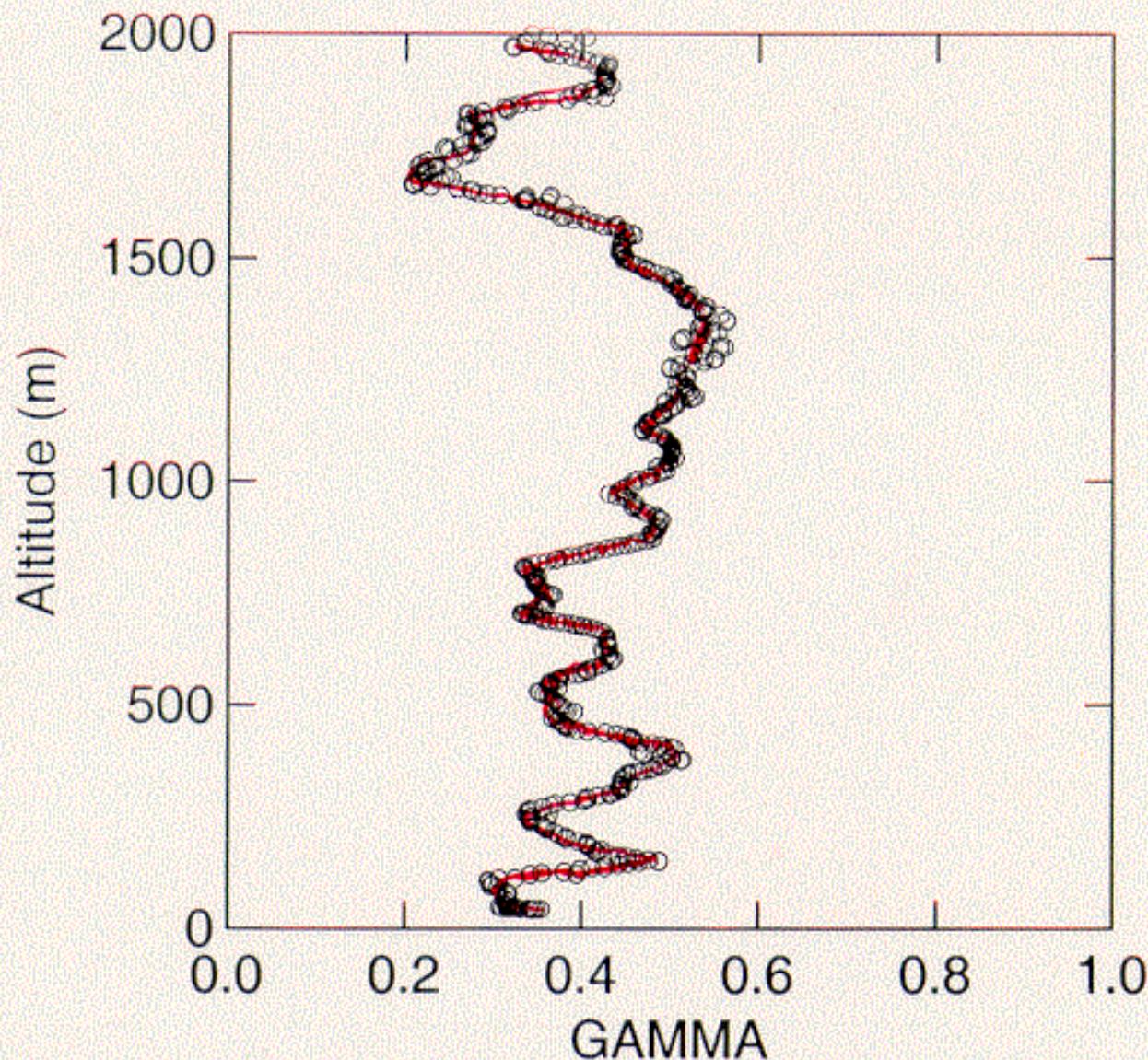
<sup>2</sup>Calculated for conditions where supermicron aerosol strongly influence scattering,  $D_{gn} = 0.4 \mu\text{m}$ ,  $\sigma_g = 1.8$ .

<sup>3</sup>Organic components of sea salt alone.

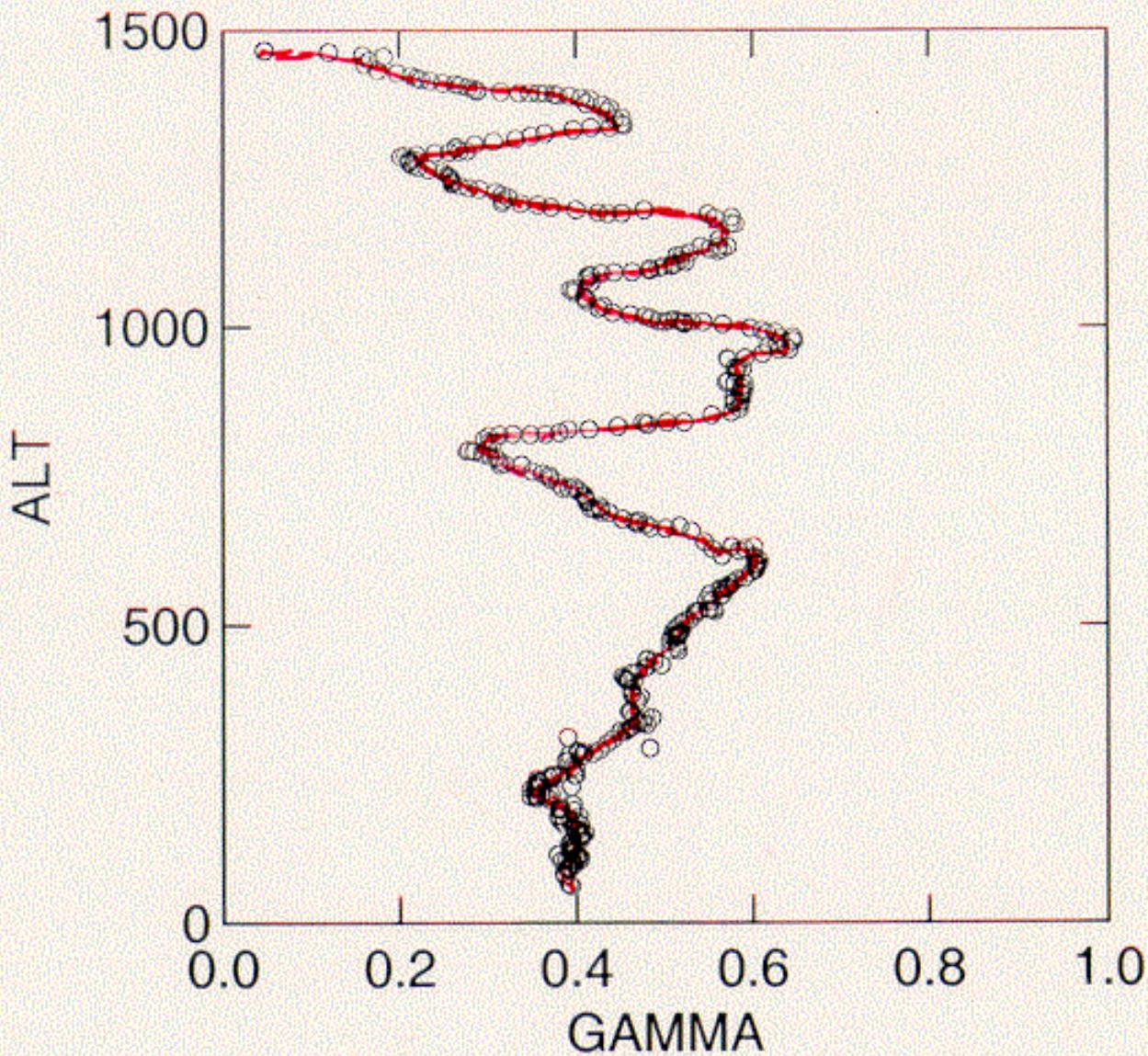
## Upwind profile, 08/27



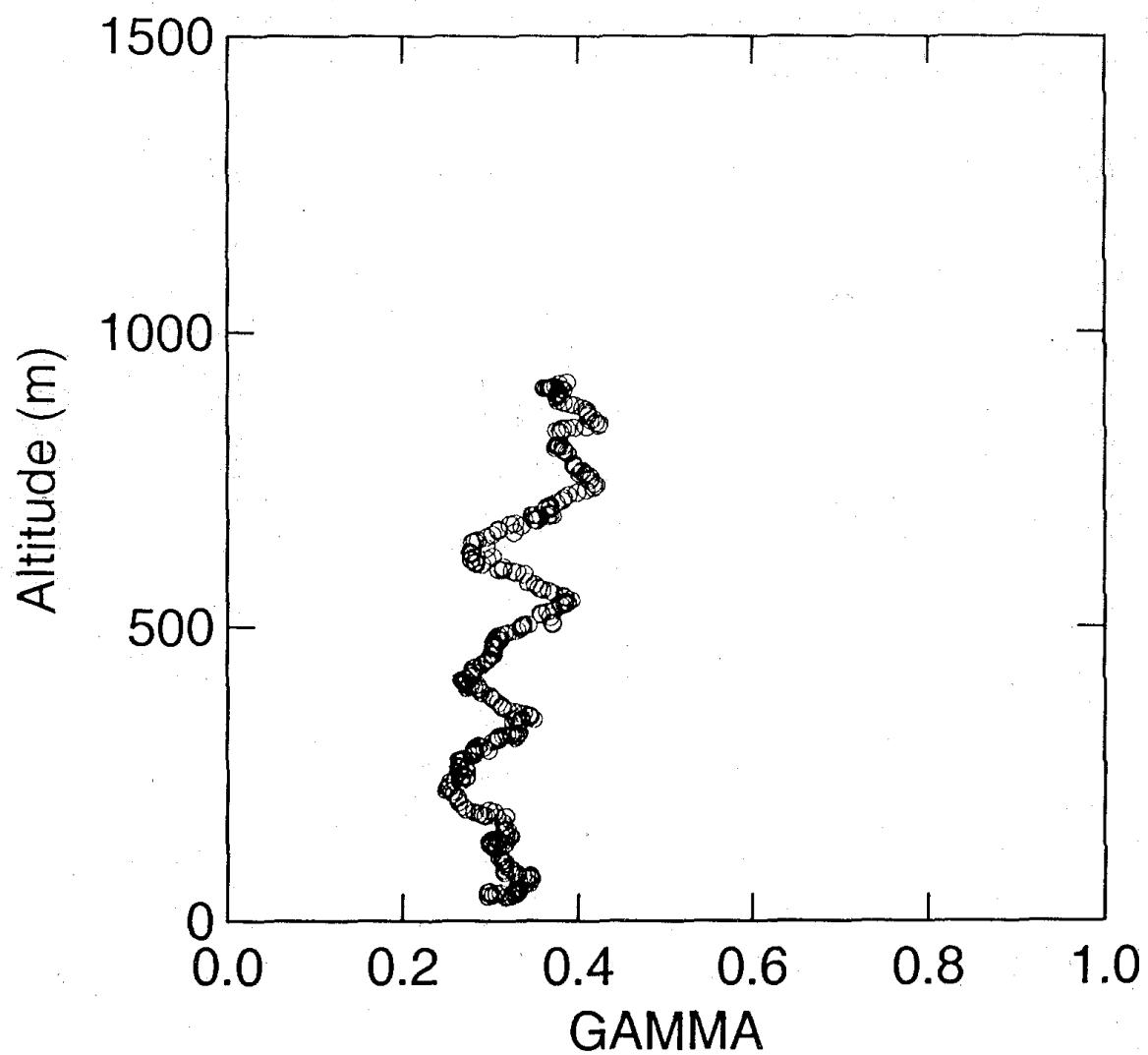
# Flip profile, 08/27



# Flip profile, 08/29

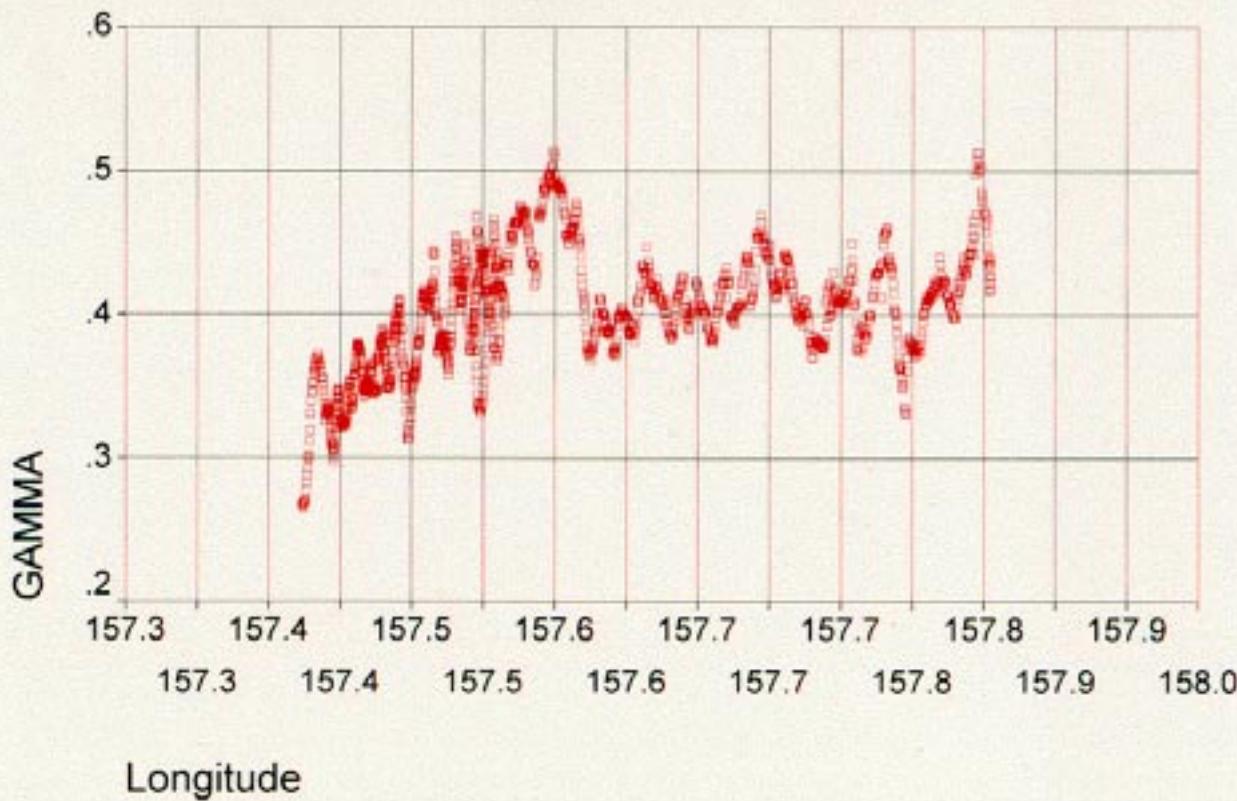


## Upwind profile, 08/29



# Longitudinal dependence of Gamma

Flight 0831, Altitude ~ 30-100 m



# **FLIP-Upwind Comparison (6 Flights)**

<b>Parameter</b>	<b>FLIP</b>	<b>40 nm Upwind</b>
$\gamma$	$0.39 \pm 0.05$	$0.31 \pm 0.05$
bsp (dry)	$13.4 \pm 2.9$	$13.8 \pm 2.7$
RH	$73.5 \pm 1.9$	$75.3 \pm 2.0$
$\text{SO}_4^{\equiv}$	$470 \pm 145$	$379 \pm 167$
$\text{NO}_3^-$	$95 \pm 95$	$170 \pm 108$

# Flip Dicarboxylic Acid Concentrations

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Species	<i>Kawamura et al.</i>		
	Mean Value (ng m <sup>-3</sup> )	(1999) Mean Value (ng m <sup>-3</sup> )	Range (ng m <sup>-3</sup> )
Glutaric Acid	2.7 ± 1.3	0.64	0.01-6.3
Succinic Acid	6.6 ± 15	2.8	0.29-16
Malonic Acid	19 ± 3.5	11	1.3-54
Oxalic Acid	11.5 ± 6.7	40	6.5-161

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## Rotated Component Matrix<sup>a</sup>

	Component		
	1	2	3
CL	-5.476E0-02	.984	-.139
NO3	.560	.633	.391
GLUTARAT	.210	7.392E-02	.918
SUCCINAT	.283	.897	-.141
MALONATE	8.079E-02	-.180	.961
SULFATE	.920	.389	-2.805E-02
OXALATE	.880	.368	.282
PHOSPHAT	.194	.646	-7.29
NSS_SO4	.984	6.651E-02	6.321E-03
FRAC_NSS	.913	-.119	8.884E-02

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 4 iterations.

# RED Cloud Water Composition (ppbm)

Flight	Sample	pH	Acetate	Formate	Cl	$\text{NO}_3^-$	$\text{SO}_4^{=}$	Oxalate	Malonate	Succinate	Glutarate
0823	1	6.1	—	190	5,688	669	1,309	68	—	4.3	—
0824	1	5.4	174	108	6,826	1,367	1,655	32	35	2.4	—
	2	5.6	161	146	14,408	2,385	3,089	—	28.6	16.9	—
0827	1	4.6	—	—	4,866	3,260	5,833	163	54.3	89	50
0829	1	4.5	202	95	14,562	1,701	3,676	75	34.6(?)	13.6	—
	2	4.4	288	81	3,047	457	1,552	100	145	1.7	—
	3	4.7	—	—	1,526	205	877	34	22	—	—
0830	1	4.7	—	—	41,080	1,132	6,683	52	51	10.3	—
	2	4.4	—	—	49,386	1,399	8,048	51	43	5.7	—
0831	1	4.4	—	—	80,831	1,302	12,860	11	72	6.6	—

## Carbohydrates in RED (ng m<sup>-3</sup>)

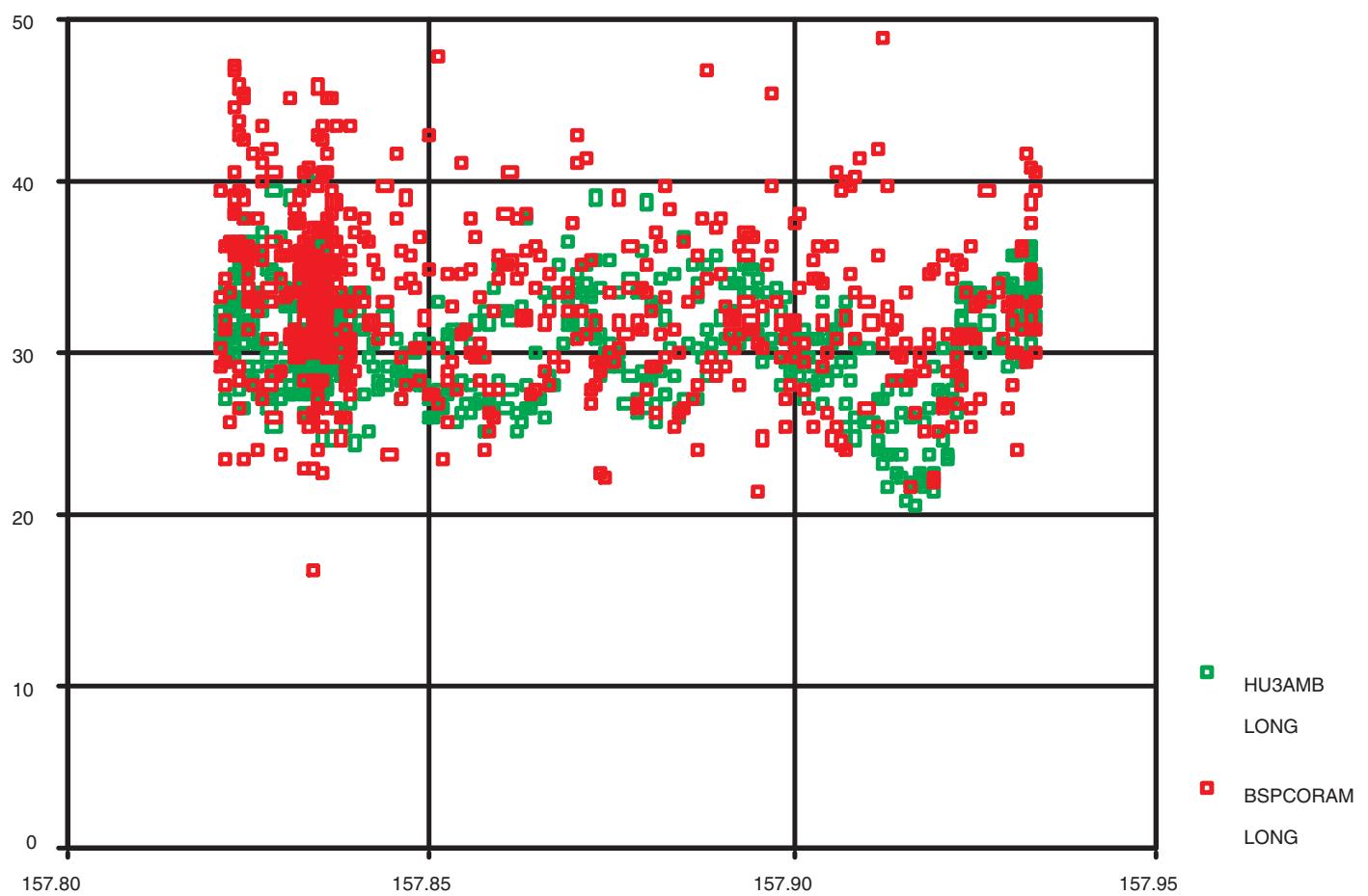
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<b>Sample</b>	<b>Levoglucosin</b>	<b>D-Glucose</b>	<b>Mannitol</b>	<b>Oxalate</b>
Twin Otter (11) 8/28/01 (40 nm, ALT = 30 m)	82.2	150	90.2	20.2
Twin Otter (13) 8/28/01 (FLIP, 200 m)	28.3	168	121	22.8
FLIP (06)	5.6	47.1	20.1	7.7
FLIP (14)	0	0	6.3	7.4
FLIP (15)	7.5	15.7	19.3	7.3

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FLT 0828, ambient bsp(550nm)

optical path, ~40 m altitude



**Signal Propagation Path**  
**AOD's (550 nm)**  
**ALT=40 m**

<b>Flight</b>	<b>Path</b>	<b>RH</b>	<b><math>\bar{\gamma}</math></b>	<b>Wind Speed*</b> <b>(ms<sup>-1</sup>)</b>	<b>AOD (dry)</b>	<b>AOD (amb)</b>
0827	EO	83	0.49	5	0.05	0.08
	RF	85		5	0.15	0.31
0828	EO	78	0.51	7	0.25	0.33
	RF	78		7	0.60	0.85
0831	EO	71	0.47	7	0.13	0.20
	RF	71		7	0.33	0.48
0904	EO	69	0.39	5	0.06	0.08
	RF	67		5	0.15	0.19

\*From FLIP